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मानक

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“Step Out From the Old to the New”

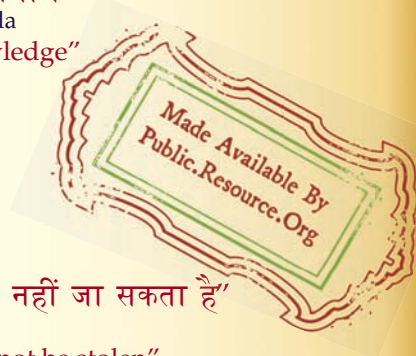
IS 4397 (1999): Cold-rolled Carbon Steel Strips for Ball and Roller Bearing Cages/Retainers [MTD 16: Alloy Steels and Forgings]



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Satyanarayan Gangaram Pitroda

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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक

बॉल और रोलर बेयरिंग केज/रिटेंर के लिए  
अतप्त बेल्लित इस्पात की पत्तियाँ — विशिष्टि  
( दूसरा पुनरीक्षण )

*Indian Standard*

**COLD-ROLLED CARBON STEEL STRIPS FOR  
BALL AND ROLLER BEARING CAGES/  
RETAINERS — SPECIFICATION**

*( Second Revision )*

ICS 77.140.50:21.100

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**BUREAU OF INDIAN STANDARDS**  
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## FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Alloy Steels and Forgings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1967 and revised in 1972. While reviewing this Indian Standard the committee felt it necessary to revise it incorporating the following main modifications:

- a) Chemical composition of existing grade has been modified.
- b) One more grade has been added.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

## *Indian Standard*

# COLD-ROLLED CARBON STEEL STRIPS FOR BALL AND ROLLER BEARING CAGES/ RETAINERS — SPECIFICATION

( *Second Revision* )

## 1 SCOPE

**1.1** This standard covers the requirements for deep drawing cold rolled carbon steel strip suitable for the manufacture of cages/retainers for ball and roller bearings.

**1.1.1** The strips shall be supplied in the skin rolled temper only and shall be non-scalloping, suitable for the blanking, deep drawing and piercing.

## 2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS/ISO No.</i>	<i>Title</i>
228	Methods for chemical analysis of steel (issued in various parts)
1501 (Part 1) : 1984	Method for Vickers hardness test for metallic materials: Part 1 HV 5 to HV100 ( <i>second revision</i> )
1599 : 1985	Method for bend test ( <i>second revision</i> )
4748 : 1988	Method for estimating the average grain size of metals ( <i>first revision</i> )
8910 : 1978	General technical delivery requirements for steel and steel products
10175 (Part 1) : 1982/ISO 8490 : 1986	Modified Erichsen cupping test for metallic sheet and strip: Part 1 Thickness up to 2 mm ( <i>first revision</i> )

## 3 CLASSIFICATION OF GRADES

Strips shall be classified in following grades:

DD — Deep drawing quality, and

EDD — Extra deep drawing quality.

## 4 SUPPLY OF MATERIALS

**4.1** General requirements relating to the supply of cold rolled carbon steel strips shall conform to IS 8910.

### 4.2 Non-ageing Characteristics

**4.2.1** The manufacturer shall guarantee the absence of stretcher strains on being cold worked in case of non-ageing quality DD/EDD grade material with a non-ageing guarantee for 6 months from the date of despatch.

## 5 MANUFACTURE

**5.1** Steel shall be manufactured by open-hearth, electric basic oxygen or combination of these processes. In case any other process is employed in the manufacture, prior approval of the purchaser shall be obtained.

**5.2** Steel shall be fully killed. However, EDD grade shall be supplied only in fully aluminium killed, or in a fully stabilized condition using micro alloying elements like Nb,V,Ti and B individually or in combination subject to mutual agreement in which case total micro alloying should not exceed 0.2 percent in analysis. However, in case of Boron, the limit shall be 0.006 percent.

## 6 CHEMICAL COMPOSITION

### 6.1 Ladle Analysis

The ladle analysis of steel when carried out either by the methods specified in relevant part of IS 228 or any other established instrumental/chemical method shall be as given in Table 1. In case of any dispute the procedure given in the relevant parts of IS 228 shall be the referee method.

**6.1.1** Elements not specified in Table 1 shall not be added to the steels except when agreed to, other than for the purpose of finishing the heat and shall not exceed the following limits:

<i>Constituent</i>	<i>Percent</i>
Chromium	0.10
Nickel	0.10
Molybdenum	0.03
Copper	0.10

## 6.2 Product Analysis

Permissible variation in case of product analysis for the limits specified in Table 1 shall be as follows:

<i>Constituent</i>	<i>Permissible Variation Over Specified Limit, Percent</i>
Carbon	0.02
Manganese	0.03
Sulphur	0.005
Phosphorus	0.005

**Table 1 Chemical Composition**  
(Clauses 6.1, 6.1.1 and 6.2)

	<b>Constituent, Percent, Max</b>				
	C	Mn	P	S	Al
Deep drawing (DD)	0.10	0.50	0.035	0.035	—
Extra deep drawing (EDD)	0.08	0.50	0.030	0.030	0.02 Min 0.06 Max

### NOTES

1 When steel is aluminium killed the Nitrogen content shall be limited to 0.01 percent maximum. When steel is not fully killed by aluminium alone, the Nitrogen content shall be limited to 0.007 percent maximum. This should be checked by occasional product analysis by the manufacturer.

2 When the steel is killed by aluminium, the total aluminium content should not be less than 0.020 percent. When the steel is silicon killed, the silicon content shall not be less than 0.10 percent. When the steel is Aluminium-Silicon killed, the silicon content shall not be less than 0.030 percent and total aluminium content shall not be less than 0.01 percent.

3 The nitrogen content of the steel shall not be more than 0.007 percent. For aluminium killed or aluminium-silicon killed steel the nitrogen content shall not exceed 0.012 percent. This shall be ensured by occasional check analysis by the manufacturer.

## 7 FREEDOM FROM DEFECTS

The finished strip shall have a clean bright and smooth surface and shall be free from harmful defects, such as laps, seams, laminations scales, rust, blisters, pitting, discolouration and cracked edges, etc.

## 8 BEND TEST

8.1 Two bend tests shall be carried out for every lot of five tonnes of materials or part thereof.

8.1.1 Where strips of more than one thicknesses are rolled from the same cast, two additional bend tests shall be made for each variation in thickness.

8.2 Bend test pieces shall be cut, one with the longer axis parallel to the direction of rolling and the other at right angles to it.

8.2.1 The edges of the bend test pieces shall be practically free from burrs. Filing or machining to remove burrs is permissible.

8.3 Bend test shall be carried out in accordance with IS 1599.

8.3.1 The angle of bend and the internal diameter of the bend for different grades of material shall be as given Table 2. The test pieces shall be deemed to have passed the test if the outer convex surface is free from cracks.

**Table 2 Bend Test for Strips in Annealed and Skin Passed Condition**

<b>Steel Grade</b>	<b>Angle of Bend</b>	<b>Internal Diameter of Bend</b>
DD	180°	a <sup>1)</sup>
EDD	180°	a

<sup>1)</sup>a = thickness for bend test piece.

## 9 HARDNESS TEST

Hardness of cold rolled strips when tested in accordance with IS 1501 (Part 1) shall be as given below:

<i>Grade</i>	<i>Min</i>	<i>Max</i>
DD	90 HV	120 HV
EDD		

## 10 CUPPING TEST

When agreed to between the purchaser and the manufacturer the Modified Erichsen cupping test shall be carried out in accordance with IS 10175 (Part 1) and the minimum cupping test values, shall be as given in Fig. 1.

10.1 The material shall not show an orange peel effect during Erichsen cupping test.

10.2 If required one cupping test shall be carried out from each lot of five tonnes of material or part thereof.

## 11 MICRO-EXAMINATION

11.1 The micro-structure of finished strip shall reveal equiaxed grains not exceeding 0.056 4 mm (IS Grain Size No. 6 to 8 of IS 4748) in size. Any pearlite present shall be uniformly distributed and shall not resolve under a magnification of 1 000 X. The presence of free carbides along the grain boundaries is undesirable.

11.1.1 Number of samples to be tested shall be as agreed to between the purchaser and the manufacturer.

## 12 RETEST

Should any of the test pieces fail to pass any of the tests specified, two further test samples shall be taken for testing in respect of each failure. In case of product analysis, the new samples shall be taken from different

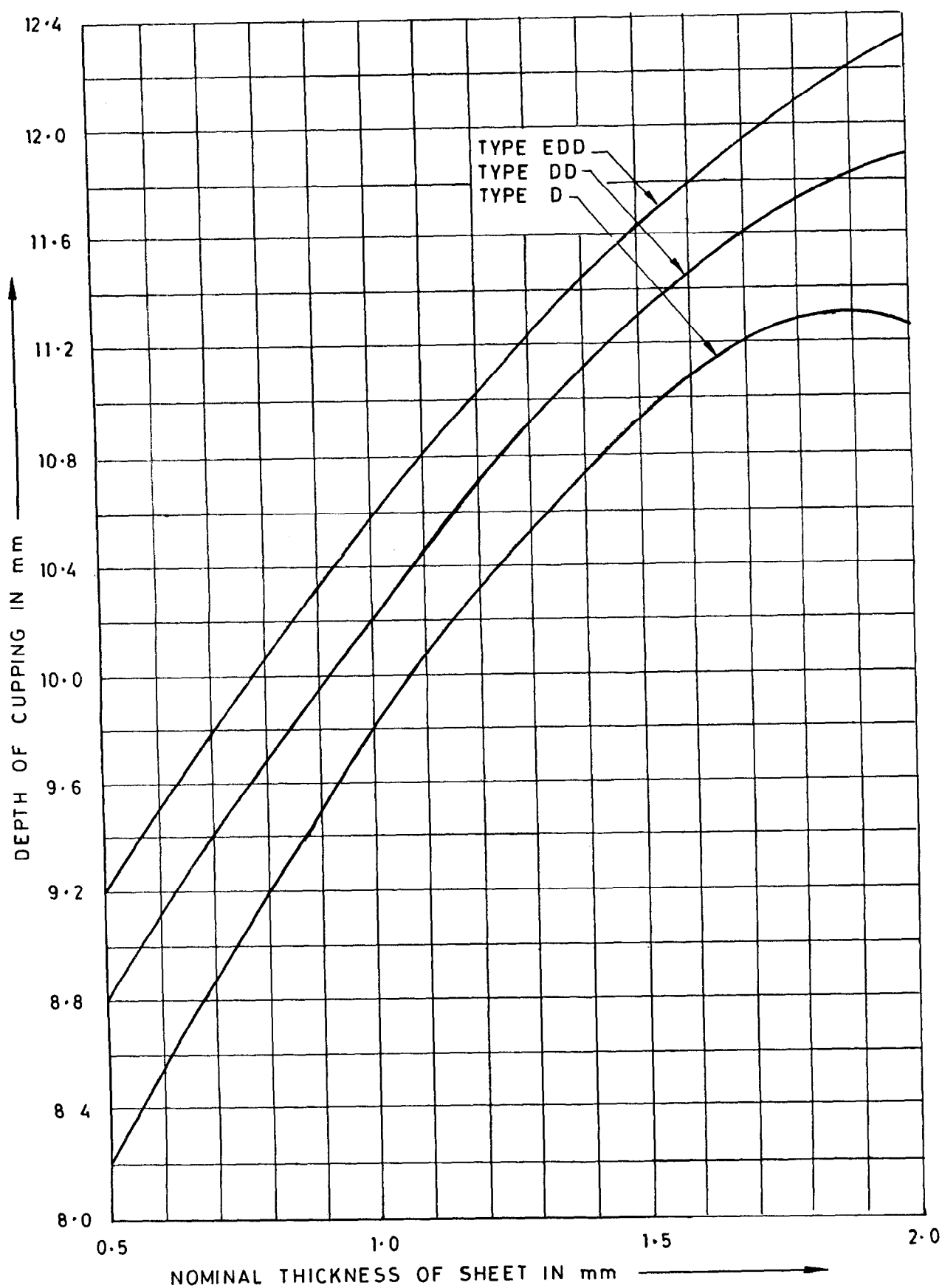


FIG. 1 MINIMUM ERICHSEN CUPPING TEST VALUES



pieces from the same cast. In case of physical tests, the new samples shall be selected from the same heat-treatment batch. Should either of the retests fail to meet the specified requirements, the batch represented shall be deemed as not conforming to the standard. However, if the failure is with respect to physical test, the batch may be further heat-treated and offered for further testing.

13 ADDITIONAL TESTS

Subject to mutual agreement between the supplier and the purchaser, any other special tests may also be specified at the time of enquiry and order.

14 ROLLING TOLERANCES

14.1 The tolerances on thickness and width of cold-rolled strips shall conform to those specified in Tables 3 and 4 respectively.

Table 3 Permissible Tolerance on Thickness

Thickness mm	Tolerance for All Widths mm
Up to 0.40	± 0.02
Over 0.40 and up to 0.80	± 0.03
Over 0.80 and up to 1.60	± 0.04
Over 1.60 and up to 3.00	± 0.05
Over 3.00	± 0.06

Table 4 Permissible Tolerances on Width

Thickness mm	Tolerance for Width		
	Up to 80 mm	Over 80 Up to 125 mm	Over 125 Up to 250 mm
Up to 1.00	± 0.15	± 0.20	± 0.30
Over 1.00 and up to 1.60	± 0.20	± 0.30	± 0.40
Over 1.60 and up to 2.50	± 0.25	± 0.35	± 0.50
Over 2.50 and up to 4.00	± 0.30	± 0.45	± 0.60
Over 4.00	± 0.40	± 0.50	± 0.60

14.1.1 When ordered to exact length, the tolerances shall be as given in Table 5.

Table 5 Tolerance of Length

Length mm	Tolerance
Up to 1 000	+ 10 mm
Above 1 000	+ 1 percent <sup>1)</sup>

NOTE — In case of strips supplied in the coil form, the tolerance on length shall not apply.

<sup>1)</sup>Maximum variation shall not exceed 30 mm for any length.

14.2 The material may be ordered to closer tolerances subject to mutual agreement between the purchaser and the supplier.

15 CONDITION OF DELIVERY

15.1 Edge Condition

Cold rolled strips shall be supplied with slit edges.

15.2 The size and weight of each coil shall be subject to mutual agreement between the purchaser and the manufacturer.

16 PACKING

The mode of packing and method of rust prevention during transit shall be subject to mutual agreement between the purchaser and the manufacturer.

17 MARKING

Every package of strips shall be legibly marked with the name or trade-mark of the manufacturer, cast number, size and mass.

## Bureau of Indian Standards

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

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### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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